

Application Number	10/712,464
Filing Date	November 12, 2003
First Named Inventor	Bang, Won B.
Art Unit	2823
Examiner Name	William D. Coleman
Attorney Docket Number	A7695/T51600

Total Number of Pages in This Submission

ENCLOSURES (Check all that apply)

- | | | |
|--|--|---|
| <input type="checkbox"/> Fee Transmittal Form
<input type="checkbox"/> Fee Attached
<input type="checkbox"/> Amendment/Reply
<input type="checkbox"/> After Final
<input type="checkbox"/> Affidavits/declaration(s)
<input type="checkbox"/> Extension of Time Request
<input type="checkbox"/> Express Abandonment Request
<input type="checkbox"/> Information Disclosure Statement

<input type="checkbox"/> Certified Copy of Priority Document(s)
<input type="checkbox"/> Reply to Missing Parts/ Incomplete Application
<input type="checkbox"/> Reply to Missing Parts under 37 CFR 1.52 or 1.53 | <input type="checkbox"/> Drawing(s)
<input type="checkbox"/> Licensing-related Papers
<input type="checkbox"/> Petition
<input type="checkbox"/> Petition to Convert to a Provisional Application
<input type="checkbox"/> Power of Attorney, Revocation
<input type="checkbox"/> Change of Correspondence Address
<input type="checkbox"/> Terminal Disclaimer
<input type="checkbox"/> Request for Refund
<input type="checkbox"/> CD, Number of CD(s) _____
<input type="checkbox"/> Landscape Table on CD | <input type="checkbox"/> After Allowance Communication to TC
<input type="checkbox"/> Appeal Communication to Board of Appeals and Interferences
<input type="checkbox"/> Appeal Communication to TC (Appeal Notice, Brief, Reply Brief)
<input type="checkbox"/> Proprietary Information
<input type="checkbox"/> Status Letter
<input checked="" type="checkbox"/> Other Enclosure(s) (please identify below):
Communication - Comments on Statement of Reasons for Allowance.
Return Postcard |
|--|--|---|

Remarks

The Commissioner is authorized to charge any additional fees to Deposit Account 20-1430.

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	Townsend and Townsend and Crew LLP
Signature	
Printed name	William L. Shaffer
Date	12/21/05

Reg. No.

37,234

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below.

Signature

Typed or printed name

Kristina Alvarez

Date

12/21/05



PATENT
Attorney Docket No.: A7695/T51600

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

WON B. BANG et al.

Application No.: 10/712,464

Filed: November 12, 2003

For: RAMP TEMPERATURE
TECHNIQUES FOR IMPROVED
MEAN WAFER BEFORE
CLEAN

Examiner: William D. Coleman

Art Unit: 2823

COMMUNICATION - COMMENTS ON
STATEMENT OF REASONS FOR
ALLOWANCE

Mail Stop Issue Fee
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

Applicants note that claim 7 recites:

7. A method of operating a substrate processing chamber, the method comprising:
- transferring a first substrate into the substrate processing chamber and heating the substrate to a first temperature of at least 510°C;
 - depositing an insulating layer over the first substrate while reducing the temperature of the substrate from the first temperature to a second temperature that is lower than the first temperature;
 - transferring the first substrate out of the substrate processing chamber;
 - removing unwanted deposition material formed on interior surfaces of the chamber during the depositing step by introducing reactive halogen species into the chamber while increasing the temperature of chamber;
 - transferring a second substrate into the substrate processing chamber and heating the substrate to the first temperature; and

depositing an insulating layer over the second substrate while reducing the temperature of the substrate from the first temperature to the second temperature;

wherein the insulating layer deposited during each depositing step is deposited within trenches formed for a shallow trench isolation structure on an integrated circuit.

Applicants also note that claim 13 recites:

13. A method of operating a substrate processing chamber having a substrate heater, the method comprising:

transferring a first substrate into the substrate processing chamber and heating the heater to a first set point that causes the substrate to be heated to a first temperature of at least 510°C;

depositing an insulating layer over the first substrate while reducing the temperature of the heater to a second set point thereby reducing the temperature of the substrate from the first temperature to a second temperature that is lower than the first temperature;

transferring the first substrate out of the substrate processing chamber;

removing unwanted deposition material formed on interior surfaces of the chamber during the depositing step by introducing reactive halogen species into the chamber while increasing the temperature of the heater from a third set point that is lower than the first set point to a fourth set point that is lower than the first set point;

transferring a second substrate into the substrate processing chamber and heating the heater to the first set point substrate to the first temperature; and

depositing an insulating layer over the second substrate while reducing the temperature of the substrate from the first temperature to the second temperature;

wherein the insulating layer comprises silicon oxide deposited from a process gas comprising ozone and TEOS.

Applicants also note that claim 15 recites:

15. A method of operating a substrate processing chamber having a substrate heater, the method comprising:

transferring a first substrate into the substrate processing chamber and heating the heater to a first set point that causes the substrate to be heated to a first temperature of at least 510°C;

depositing an insulating layer over the first substrate while reducing the temperature of the heater to a second set point thereby reducing the temperature of the substrate from the first temperature to a second temperature that is lower than the first temperature;

transferring the first substrate out of the substrate processing chamber;

removing unwanted deposition material formed on interior surfaces of the chamber during the depositing step by introducing reactive halogen species into the chamber while increasing the temperature of the heater from a third set point that is lower than the first set point to a fourth set point that is lower than the first set point;

transferring a second substrate into the substrate processing chamber and heating the heater to the first set point substrate to the first temperature; and

depositing an insulating layer over the second substrate while reducing the temperature of the substrate from the first temperature to the second temperature;

wherein the substrate is heated by a substrate heater embedded in a ceramic pedestal during the removing step.

Applicants also note that claim 17 recites:

17. A method of operating a substrate processing chamber having a substrate heater, the method comprising:

transferring a first substrate into the substrate processing chamber and heating the heater to a first set point that causes the substrate to be heated to a first temperature of at least 510°C;

depositing an insulating layer over the first substrate while reducing the temperature of the heater to a second set point thereby reducing the temperature of the substrate from the first temperature to a second temperature that is lower than the first temperature;

transferring the first substrate out of the substrate processing chamber;

removing unwanted deposition material formed on interior surfaces of the chamber during the depositing step by introducing reactive halogen species into the chamber while increasing the temperature of the heater from a third set point that is lower than the first set point to a fourth set point that is lower than the first set point;

transferring a second substrate into the substrate processing chamber and heating the heater to the first set point substrate to the first temperature; and

depositing an insulating layer over the second substrate while reducing the temperature of the substrate from the first temperature to the second temperature;

wherein the insulating layer deposited during each depositing step is deposited within trenches formed for a shallow trench isolation structure on an integrated circuit.

Applicants also note that claim 18 recites:

18. A method of operating a substrate processing chamber of the type used to fabricate integrated circuits, the method comprising:

transferring a first substrate into the substrate processing chamber;

depositing a silicon oxide film over the first substrate by introducing TEOS and ozone gases into the chamber and maintaining the chamber at a pressure of between about 45 to 700 Torr, wherein the depositing step includes forming a first portion of the silicon oxide film while heating the substrate to a temperature of at least 510°C using a substrate heater and forming a second portion of the silicon oxide film over the first portion while reducing the temperature of the substrate;

transferring the substrate out of the chamber;

thereafter, removing unwanted deposition material from interior surfaces of the chamber by introducing a fluorine-containing etchant gas into the chamber;

during the removing step, ramping up the temperature of the substrate heater to increase the chamber temperature;

transferring a second substrate into the substrate processing chamber; and

depositing a silicon oxide film over the second substrate disposed by introducing TEOS and ozone gases into the chamber and maintaining the chamber at a pressure of between

about 45 to 700 Torr, wherein the depositing step includes forming a first portion of the silicon oxide film while heating the substrate to a temperature of at least 510°C using a substrate heater and forming a second portion of the silicon oxide film over the first portion while reducing the temperature of the substrate.

Applicants also note that claim 25 recites:

25. A method of operating a substrate processing chamber having at least interior surface comprising one aluminum, aluminum oxide or aluminum nitride, the method comprising:

transferring a first substrate into the substrate processing chamber;

depositing a dielectric layer over the first substrate using a high temperature chemical vapor deposition in which the substrate reaches a peak temperature of at least 510°C and at the conclusion of the depositing step the temperature of the substrate is reduced from the peak temperature to a second temperature that is at least 30°C lower than the peak temperature, wherein the depositing step results in unwanted dielectric material being deposited on the least one interior surface of the chamber;

transferring the first substrate out of the substrate processing chamber;

thereafter, removing the unwanted deposition material formed on the at least one interior surface of the chamber during the depositing step by introducing reactive fluorine species into the chamber;

thereafter, transferring a second substrate into the substrate processing chamber;

and

depositing a dielectric layer over the second substrate using a high temperature chemical vapor deposition in which the substrate reaches a peak temperature of at least 510°C and at the conclusion of the depositing step the temperature of the substrate is reduced from the peak temperature to a second temperature that is at least 30°C lower than the peak temperature.

Applicants also note that claim 29 recites:

29. A method of operating a substrate processing chamber, the method comprising:

transferring a first substrate into the substrate processing chamber and heating the substrate to a first temperature of at least 510°C;

depositing an insulating layer over the first substrate while reducing the temperature of the substrate from the first temperature to a second temperature that is lower than the first temperature;

transferring the first substrate out of the substrate processing chamber;

removing unwanted deposition material formed on interior surfaces of the chamber during the depositing step by introducing reactive halogen species into the chamber while increasing the temperature of chamber;

transferring a second substrate into the substrate processing chamber and heating the substrate to the first temperature; and

depositing an insulating layer over the second substrate while reducing the temperature of the substrate from the first temperature to the second temperature,

wherein the substrate processing chamber includes at least one component comprising aluminum, aluminum oxide or aluminum nitride that has a surface upon which unwanted deposition material is formed during each of the depositing steps.

Applicants also note that claim 30 recites:

30. A method of operating a substrate processing chamber having a substrate heater, the method comprising:

transferring a first substrate into the substrate processing chamber and heating the heater to a first set point that causes the substrate to be heated to a first temperature of at least 510°C;

depositing an insulating layer over the first substrate while reducing the temperature of the heater to a second set point thereby reducing the temperature of the substrate from the first temperature to a second temperature that is lower than the first temperature;

transferring the first substrate out of the substrate processing chamber;

removing unwanted deposition material formed on interior surfaces of the chamber during the depositing step by introducing reactive halogen species into the chamber

while increasing the temperature of the heater from a third set point that is lower than the first set point to a fourth set point that is lower than the first set point;

transferring a second substrate into the substrate processing chamber and heating the heater to the first set point substrate to the first temperature; and

depositing an insulating layer over the second substrate while reducing the temperature of the substrate from the first temperature to the second temperature,

wherein the substrate processing chamber includes at least one component comprising aluminum, aluminum oxide or aluminum nitride that has a surface upon which unwanted deposition material is formed during each of the depositing steps.

Applicants also note that claim 31 recites:

31. A method of operating a substrate processing chamber of the type used to fabricate integrated circuits, the method comprising:

transferring a first substrate into the substrate processing chamber;

depositing a silicon oxide film over the first substrate by introducing TEOS and ozone gases into the chamber and maintaining the chamber at a pressure of between about 45 to 700 Torr, wherein the depositing step includes forming a first portion of the silicon oxide film while heating the substrate to a temperature of at least 510°C using a substrate heater and forming a second portion of the silicon oxide film over the first portion while reducing the temperature of the substrate;

transferring the substrate out of the chamber;

thereafter, removing unwanted deposition material from interior surfaces of the chamber by introducing a fluorine-containing etchant gas into the chamber;

during the removing step, ramping up the temperature of the substrate heater to increase the chamber temperature;

transferring a second substrate into the substrate processing chamber; and

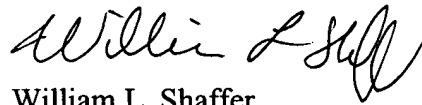
depositing a silicon oxide film over the second substrate disposed by introducing TEOS and ozone gases into the chamber and maintaining the chamber at a pressure of between about 45 to 700 Torr, wherein the depositing step includes forming a first portion of the silicon

oxide film while heating the substrate to a temperature of at least 510°C using a substrate heater and forming a second portion of the silicon oxide film over the first portion while reducing the temperature of the substrate,

wherein the substrate processing chamber includes at least one component comprising aluminum, aluminum oxide or aluminum nitride that has a surface upon which unwanted deposition material is formed during each of the depositing steps.

None of the prior art references teach or suggest a method as recited in any of these claims.

Respectfully submitted,



William L. Shaffer
Reg. No. 37,234

TOWNSEND and TOWNSEND and CREW LLP
Two Embarcadero Center, Eighth Floor
San Francisco, California 94111-3834
Tel: (650) 326-2400 / Fax: (415) 576-0300
WLS/ka
60663498 v1